



11-15-06

Patent

AF

Attorney Docket No. 1034345-000086

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Nathan S. Lewis *et al.*

Application No.: 09/409,644

Filed: October 1, 1999

For: CONDUCTIVE ORGANIC
SENSORS, ARRAYS AND
METHODS OF USE

) Group Art Unit: 1743

) Examiner: Arlen Soderquist

) Appeal No.: 1

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Kim A. Cabello

RESPONSE TO NOTICE OF NON-COMPLIANT APPEAL BRIEF

Mail Stop APPEAL BRIEF - PATENTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Notice of Non-Compliant Appeal Brief, issued by the United States Patent & Trademark Office on November 8, 2006, applicant submits the following for consideration:

1. A copy of the Supplemental Appeal Brief as filed April 25, 2005;
2. Evidence Appendix, containing Figures 1 and 2 (as previously provided on April 25, 2005); and
3. Related Proceedings Appendix, indicating that there are no related proceedings.

This submission does not raise new issue or change the substance of the Appeal (the attached has been previously considered by the Examiner). This submission merely corrects a formality related to references to the Appendices.

No additional fee is believed to be necessary in connection with the filing of the above. However, should a fee be required the Commissioner is hereby


authorized to charge any appropriate fees that may be required by this paper or to credit any overpayment to Deposit Account No. 02-4800. This papers is submitted in duplicate.

Respectfully submitted,

Buchanan Ingersoll & Rooney L.L.P.

Date November 13, 2006

By:



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) Kim A. Cabello

SUPPLEMENTAL APPEAL BRIEF

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This appeal is from the decision of the Primary Examiner dated April 20, 2004, finally rejecting claims 98-110, 112-123 and 126-159. An Appeal Brief was submitted on November 5, 2004 (incorporated herein by reference in its entirety), perfecting the Notice of Appeal originally mailed on August 20, 2004.

Prosecution in the application was re-opened by the Examiner on January 25, 2005, and this Supplemental Appeal Brief is filed pursuant to 37 C.F.R. §41.31 and MPEP § 1208.02 along with a Request for Reinstatement of the Appeal.

No fee is believed to be due for Reinstatement of the Appeal or consideration of this Supplemental Appeal Brief. However, the Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800.

(1) Real Parties in Interest

The application is assigned of record to California Institute of Technology, who is hence a real party in interest. Carol Lewis, an inventor, is also a real party in interest.

(2) Related Appeals and Interferences

There are no known related appeals or interferences.

(3) Status of Claims

Claims 1-49, 73-84, 91-97, 111, and 124-125 are canceled. Claims 50-72, 85-90, 98-110, 112-123 and 126-159 are pending. Of those claims, claims 50-72 and 85-90 are withdrawn from consideration. Claims 98-110, 112-123 and 126-159 stand rejected.

(4) Status of Amendments

A response after final was filed on July 12, 2004. No amendments were introduced in the response. Applicants' remarks were entered in full in paper number 36.

(5) Summary Claimed Subject Matter

The summary of claimed subject matter provided in the Appeal Brief filed November 5, 2004, is incorporated herein by reference.

(6) Grounds of Rejection to be Reviewed on Appeal

The Examiner has alleged that claim 158 is allegedly indefinite under 35 U.S.C. §112, second paragraph in the new grounds of rejection applied in the Office Action mailed January 25, 2005.

The Examiner has alleged that claims 98-110, 112-113, 115, 117-123, 126-135, 137, 139-157 and 159 are unpatentable under 35 U.S.C. §103(a) over Gibson (WO 96/07901) in view of Barisci (Trends in Polymer Science, 1996) and Casella (Analytica Chimica Acta, 335:217-225, 1996), Thackeray *et al.* (J. Phys. Chem.,

90(25):6674-6679, 1995), Yamato *et al.* (Synth. Met. 87:231-236, 1997), Naarmann (DE 3,728,452), Li (Materials Research Society Symposium Proceedings, 1995), Sakaguchi (JP 4-2958), Stetter (U.S. Patent 5,512,882) or Wampler (Chem. Mater. 7(3):585-592, 1995).

The Examiner has alleged that claims 114, 116, 136, 138 and 158 are unpatentable under 35 U.S.C. §103(a) over Gibson (WO 96/07901) in view of Barisci (Trends in Polymer Science, 1996) and Casella (Analytica Chimica Acta, 335:217-225, 1996), Thackeray *et al.* (J. Phys. Chem., 90(25):6674-6679, 1995), Yamato *et al.* (Synth. Met. 87:231-236, 1997), Naarmann (DE 3,728,452), Li (Materials Research Society Symposium Proceedings, 1995), Sakaguchi (JP 4-2958), Stetter (U.S. Patent 5,512,882) or Wampler (Chem. Mater. 7(3):585-592, 1995) as applied to claims 108, 113, 115, 128, 135, 137 or 152 above, and further in view of Breheret (Colloq. Inst. Natl. Rech. Agron. 75:103-107, 1995), Mifsud (U.S. Patent No. 5,801,297; Mifsud I) and Mifsud (WO 95/08113; Mifsud II), Moy (Bioflavour 95(75):55-58, 1995) or Persaud (WO 86/01599).

7. Arguments

I. REJECTION UNDER 35 U.S.C. §112, SECOND PARAGRAPH

Claim 158 stands rejected as allegedly indefinite for failing to define whether the "polymer" in the member of the Markush group "carbon black-polymer composite" is an insulating polymer of a conducting polymer. Applicants submit that the specification teaches that the polymer can be insulating as described in U.S. Patent No. 5,571,401 or may be a conducting polymer as described throughout the present specification. Thus, the claim is not indefinite.

II. REJECTION UNDER 35 U.S.C. §103

The Arguments provided in the Appeal Brief filed November 5, 2004, are incorporated herein by reference. In addition, the following arguments are provided to address the rejections and arguments alleged by the Examiner in the Office Action mailed January 25, 2005.

A. REJECTION OF CLAIMS 98-110, 112-113, 115, 117-123, 126-135, 137, 139-157 AND 159 OVER GIBSON IN VIEW OF BARISCI AND FURTHER IN VIEW OF CASELLA, THACKERAY *ET AL.*, YAMATO, NAARMANN, LI, SAKAGUCHI, STETTER OR WAMPLER

1. The Technology

The sensor systems for the purpose of this appeal, can be divided into two general categories: (i) conductimetric sensors and (ii) amperometric sensors (sometimes referred to as electrochemical sensors).

a. Conductimetric Sensors

Figure 1 of the Appeal Brief filed November 5, 2004, is attached hereto. A general structural schematic and system of a conductimetric sensor and system of the invention is provided in FIG.1. Figure 1 shows two conductive leads (10) on opposite ends and separated by a sensing area (20). A sensing area can be disposed upon a non-conductive substrate, backing, or other material (30). The sensing area comprises a conductive organic material (40) and a conductive material compositionally different than the conductive organic material (50). An electrical measuring device (60) is coupled to the conductive leads (10) and measures, for example, the resistance change between the leads (e.g., the resistance change of the sensing area).

During operation the sensing area (20) directly absorbs, adsorbs or imbibes an analyte (70). The analyte causes the conductive materials to change in conductivity thereby causing a measurable change in resistance as measured by the electrical measuring device (60). This change in conductivity/resistance is used to determine if a particular analyte or class of analytes is present in a sample.

In the Office Action mailed January 25, 2005, the Examiner alleges that the representation in Figure 1, provided in the Appeal Brief is not an accurate representation of the different sensor types because Figure 1 appears to show the regions as regular stacked, separate, alternating regions rather than the random regions that exist. Applicants respectfully submit that Figure 1 provides a "general" representational schematic. The materials can be random or stacked, as depicted. For example, the specification teaches that ink-jet printing techniques can be used

wherein the different materials can be selectively deposited in an ordered manner (see, e.g., page 44, lines 1-13).

b. Amperometric-Electrochemical Sensors

A general structural schematic and system of an amperometric-electrochemical sensor is provided in Figure 2 (attached hereto; also provided in the November 5, 2004, Appeal Brief). With reference to Figure 2 there is shown three electrodes (10A-C) each connected to an electrical measuring device (20) by a single conductive lead (30). An amperometric-electrochemical sensor system requires additional electrodes immersed in a liquid electrolyte. Each electrode (10) is attached to a circuit using a single conductive lead (30). The electrons (40) involved in the electrochemical reaction flow from the working electrode (10a) through the external circuit (50), producing the output signal of the sensor. During operation the materials of the electrodes are selected such that they do not change in resistance as that would defeat the function of the amperometric-electrochemical sensor system. An analyte is contacted with, for example, an aqueous buffer (60) that is in contact with a sensor. The analyte causes a change in the ionic species present in the electrolyte liquid.

In amperometric-electrochemical sensors, the resistance of the electrode body is not sensed at all to produce a registered signal. Rather, charge flow across the electrode/solution interface is sensed. The material of an amperometric-electrochemical sensor experiences both (i) a flow of electrons and (ii) a flow of ions into, onto or out of the material. In this manner the sensor of the electrochemical system undergoes an oxidation or reduction thereby changing electron flow through the system between a cathode electrode and an anode electrode. While the resistance of the electrode body is determined by the composition and arrangement of the electrode body, charge flow across the electrode/solution interface is determined by a variety of other factors, including the capacitance between the electrode and the solution and the availability of electronic states at the electrode surface that can participate in charge transfer with species in the solution. Accordingly, the *analyte does not come into direct contact with the sensor otherwise charge cannot flow through the circuit.*

Amperometric-electrochemical sensors serve certain uses in particular areas of sensing oxidation-reduction (e.g., pH sensing) but have limited utility in the areas

of identifying analytes as recognized in the art. In particular, electrodes in electrochemical systems can undergo degradation, usually caused by over-oxidation occurring during electrochemical cycling (see, *e.g.*, Sestak at page 118, second full paragraph under "Introduction"; Sestak is of record in the present case).

Furthermore, the materials chosen to act as electrodes in amperometric-electrochemical sensors are selected based, at least in part, on the fact that their conductivity is not "sensed" in the amperometric-electrochemical sensor and preferably does not change during operation. Accordingly, one of skill in the art would not look to or expect that materials present in amperometric-electrochemical electrodes would be useful in conductimetric sensor for the simple fact that they are not intended and would not function properly if they were to change conductivity. This "invisibility" is inapposite to the role of sensing materials in conductimetric sensors. Indeed, "sensing" the conductive properties of amperometric-electrochemical sensor electrodes will render the electrodes unfit for their intended use as sensors in amperometric-electrochemical systems. In fact, it is not the case at all that materials that are good electrochemical detectors will make good chemiresistors so obviousness does not flow from one to the other. An example of this is the use of ferrosine modified enzymatic sensors to detect glucose. These are good electrochemical sensors but make completely useless chemiresistors because in fact they are electronically resistive to DC current in both the oxidized and reduced states. This property is what makes such ferrosine modified enzymatic sensors useful as an amperometric sensor to detect a glucose analyte by way of a change in an ion flow and charge flow into the film.

2. The Cited References

The references can be divided into two general categories similar to the categories of "Technology" discussed above (*i.e.*, conductimetric and amperometric-electrochemical sensors).

The Examiner alleges at page 15, lines 1-11 of the Office Action mailed January 25, 2005, that it would be obvious to one of ordinary skill in the art at the time the invention was made to:

...incorporate the teachings of Casella, de Lacy Costello, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler relative to the incorporation of conductors such as carbon black, anions of tetrathiafulvalene derivatives, metal particles or metal oxide into the conductive organic polymers

used in the sensing arrays of Gibson because of their sensitivity to known analyte gases or enhanced sensing and/or stability properties as taught by each of Casella, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi or Wampler compared to sensors made with only the conductive polymers taught by Gibson and the recognized ability and expectation of the Gibson conductive polymers to be affected by interactions in a number of sensing formats in a manner that change the electronic structure and as a result the resistivity of the polymer as shown by Barisci.

Applicants submit that Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi and Wampler do not teach materials that are sensitive to known analyte gases, but rather teach materials that promote catalysis in REDOX reactions and thus serve as amperometric-electrochemical sensors. Furthermore, Barisci teaches different sensor systems including the importance that in amperometric-electrochemical sensors that the electrode materials remain capable of conducting ions and electrons, which is contrary to the function of Applicants' claimed invention.

Applicants respectfully submit that the Examiner has not set forth a *prima facie* case of obviousness. A *prima facie* case of obviousness requires that three criteria be met. MPEP §2143. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); MPEP §2143.

Determining obviousness under 35 U.S.C. §103 requires an analysis of the claimed invention as a whole, and focusing on the obviousness of substitutions and differences, instead of on the invention as a whole, is a legally improper way to simplify that determination. *Gillette Co. v. S.C. Johnson & Son Inc.*, 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). Thus, changes from the prior art, whether or not "minor", must be evaluated in terms of the whole invention, including whether the prior art provides any teaching or suggestion to one of ordinary skill in the art to make such changes to produce the claimed invention. *Northern Telecom Inc. v. Datapoint Corp.*, 15 USPQ 2d 1321, 1324 (Fed. Cir. 1990). Here, the Examiner is substituting materials that serve different purposes and are selected based upon

different properties (i.e., the materials of amperometric sensors are selected, in part, because they do not change conductivity).

The Examiner alleges that a combination of no less than three references would result in the claimed invention. However, there is no suggestion in any of the references for the proposed combination. As the CAFC stated in *ACS Hospital Systems Inc. v. Montefiore Hospital*, 221 USPQ 929, 933 (1984):

Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined *only* if there is some suggestion or incentive to do so.

In order to justify the combination of references proposed by the Examiner one of skill in the art would be required to discard teachings in the art indicating that (1) polymer sensors are not sensitive to analytes (see, e.g., Breheret and Mifsud I and II), (2) that polymer materials in amperometric-electrochemical sensors undergo degradation (see, e.g., Sestak), and (3) that materials that are selected in amperometric sensors are useful because they don't change conductivity. One of skill in the art would be required to discard the fundamental different operating conditions and principles of materials used in amperometric-electrochemical systems, namely that the materials be invisible to the system (i.e., they do not change their ability to conduct ions or electrons), to arrive at Applicants' invention which necessitates that the materials undergo a change in conductivity when contacted with an analyte.

The prior art must suggest the desirability of the claimed invention. MPEP §2143.01. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); MPEP §2143.01. As will become readily apparent from a review of the references cited in the pending rejection, the proposed combination would require that one of skill in the art discard the fundamental principles and necessity of selecting materials for amperometric-electrochemical sensors based upon their ability to conduct ions and electrons and believe, without

any suggestion in the art, that these materials would be useful as materials that change conductivity in conductimetric sensors and systems. The combination would require that one of skill in the art discard the requirement of electron and ion flow in amperometric-electrochemical systems and leap to a conclusion that amperometric-electrochemical materials are useful in systems, such as Applicants', that do not support ion flow. Furthermore, one of skill in the art would be required to discard teachings that polymer materials, although lacking sensitivity and usefulness, would be useful in composite materials in conductimetric sensors.

In the references presented in the pending rejection numerous references actually teach away from the combination. For example, Breheret and Mifsud I and II actually teach away from the use of the polymer materials found in Gibson. Furthermore, Sestak teaches away from amperometric-electrochemical materials as they degrade due to oxidation. Accordingly, one of skill in the art would not be motivated to combine polymer sensors or amperometric-electrochemical sensors to arrive at Applicants' invention. As indicated in *In re Ratti*, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959); MPEP §2143.01.

Applicants respectfully submit that when viewed as a whole, the combination of references proposed by the Examiner is based upon hindsight. In particular, the Examiner has combined certain references that have nothing to do with the invention as a whole, but are combined merely because they might possibly teach an element of Applicants' claims, even when such references are from non-analogous art (*e.g.*, the Wampler reference discussed more fully below). It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. *In re Gorman*, 933 F.2d 982, 987, 18 USPQ2d 1885, 1888 (Fed. Cir. 1991). *See also Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138, 227 USPQ 543, 547 (Fed. Cir. 1985)). "One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988); *In re Fritch*, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992).

Accordingly, Applicants respectfully submit that a *prima facie* case of obviousness has not been provided because (1) there is no motivation to combine or modify the references as suggested by the Examiner, (2) the combination is based upon hindsight reconstruction, (3) that the combination would require that one of skill in the art discard fundamental principles of sensor operation, and (4) that when combined the references fail to teach or suggest each and every element of Applicants' claimed invention.

2. The Primary Reference, Gibson

The primary reference, Gibson, is directed to the general field of conductimetric sensors. Gibson, however, does not teach each and every element of Applicants' claimed invention. The Examiner agrees that Gibson, as the primary reference, does not anticipate the claims. However, the Examiner alleges that the "monomers" disclosed in Gibson are considered compositionally different materials for the purposes of Applicants' claimed invention. In particular, the Examiner refers to pages 2-3 and pages 11-13 of Gibson, which allegedly teach the use of conductive polymers and "copolymers".

a. Gibson Does Not Teach Two Different Conductive Materials Forming Regions Of Compositionally Different Materials

The Examiner alleges that Gibson teaches a material having two different monomers used to form a copolymer, which the Examiner is treating as within the scope of two different conducting materials. Applicants respectfully disagree that the polymers of Gibson are within the scope of two compositionally different conductive materials.

One of skill in the art recognizes that the term "copolymers" means the polymerization of two or more monomeric units to form a polymer. Applicants respectfully submit that two monomers when reacted together (*i.e.*, polymerized) do not form two "compositionally different" materials. The two monomers react to become a single polymeric material that cannot be separated into two monomeric materials for the purposes of defining the properties in the polymeric material. Furthermore, a polymer has physical and chemical properties specific for the polymer, not the monomers. This is a fundamental principle of chemistry. When two

monomers are reacted to become a polymer, the conductive properties of the polymer are not the conductivity of each monomer, but are the physical-chemical properties of the polymer, not the monomers. For example, table salt (NaCl) has characteristics specific for the compound (*i.e.*, no net charge). In contrast, the individual atoms form the compounds of metallic sodium and chlorine gas that behave differently than the compound sodium chloride and thus behave differently compared to the compound, NaCl. Thus, the combination of the two materials, sodium and chlorine, form one new material, sodium chloride, not two different materials.

The Examiner directs Applicants to page 13 of Gibson, which allegedly elaborates on what constitutes a blend of the polymer compounds and how the blend is different from the copolymers (see, *e.g.*, the Office Action mailed January 25, 2005, at page 5, lines 26-27). Applicants submit that page 13 does not clarify what constitutes a blend and thus is non-enabling for anything other than the generation of polymers wherein two monomers (*i.e.*, copolymers) are reacted together. However, the Examiner also indicates in the Office Action mailed January 25, 2005, at page 5, lines 27-29, that Gibson does not teach blends or mixtures with inorganic conductors, organic conductors, and mixed inorganic/organic conductors.

Applicants' claims recite that the materials of the sensor are "compositionally different". Furthermore, Applicants' claims specify that the sensors are comprised of a compositionally different material, wherein the compositionally different material is "selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor. . ." (see, *e.g.*, claim 98). Gibson does not teach or suggest such an element as admitted by the Examiner.

b. Gibson Does Not Teach Or Suggest Materials Comprising Non-Organic Polymers

Applicants' claims clearly recite that the sensing area comprises ". . . alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads. . ." (see, *e.g.*, claim 98). The Office Action mailed May 7, 2003 (Paper No. 29) states at page 3, lines 13-16, "Gibson does not teach. . . two materials . . . mixed together to form as a single sensing material having the compositionally different conductive material within the

conductive organic material or as a sensing array having sensors that are not organic polymer based." This quotation from the Office Action, and by the Examiner's admission, clearly indicates that Gibson alone does not teach or suggest Applicants' claimed invention.

Accordingly, it is clear that Gibson does not teach or suggest a compositionally different conductive material:

... selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof. . .

The Examiner agrees at page 3 of the Final Office Action mailed April 20, 2004 (Paper No. 35) that Gibson does not teach or suggest such "[non]-organic polymer based" sensors.

c. Breheret and Mifsud I and II Teach Away From The Use Of Polymer Sensor Materials

Breheret (of record and cited in the pending rejections discussed more fully below) actually teaches away from polymer sensors. For example, Breheret teaches in the "Abstract" and at page 106, lines 17-20, that polymer sensors are not as effective in discriminating odors compared to semiconductor sensors. Furthermore, Mifsud I (U.S. Patent No. 5,801,297) teaches away from the polymer sensors because polymer sensors "are less sensitive than the semiconductive sensors." (See, e.g., column 1, lines 62-64). Thus, one of skill in the art desiring to develop a sensor with high sensitivity and the ability to discriminate odors would not have been motivated to utilize polymer sensors such as those taught by Gibson, particularly in combination with other materials as alleged by the Examiner.

3. Gibson in view of Barisci

To overcome the admitted deficiencies of the primary reference, Gibson, the Examiner combines Gibson with Barisci. The teachings of Gibson have been addressed above.

i. Barisci Does Not Provide Any Motivation To Combine Conductimetric Sensors
And Amperometric-Electrochemical Sensors

The Examiner alleges in the Office Action mailed January 25, 2005, that Barisci provides teachings which would lead one of skill in the art to identify with the properties of the materials in amperometric-electrochemical sensors as having utility in conductimetric sensors (see, *e.g.*, the Office Action mailed January 25, 2005, page 18, lines 24-28). Furthermore, the Examiner alleges that one of skill in the art would expect the interactions leading to measurable changes by one measurement technique (amperometric-electrochemical) to be predictable for a second different type of measurement technique (conductimetric). Applicants respectfully disagree. As stated above, amperometric-electrochemical sensor materials serve their function in such amperometric-electrochemical systems because they are "invisible" to the system. They are selected based upon the fact that they conduct electrons or ions and do not change conductivity. In contrast, materials in conductimetric systems are intended to change conductivity or react (*i.e.*, adsorb, absorb, imbibe) the analyte.

Applicants submit that the teachings in the art demonstrate the fundamental different principles of operation of amperometric-electrochemical sensors compared to conductimetric sensors including the fact that materials of amperometric-electrochemical sensors are selected to not change resistance during operation. Furthermore, the references of record teach the difficulties of such amperometric-electrochemical sensor systems and the problems with sensor degradation. Respectfully, the Examiner has ignored the factual teachings of record and maintained a combination that is not supported by the references or those of skill in the art. The rejections of record maintain the combination of polymer sensors (*i.e.*, organic polymer sensors) with amperometric-electrochemical sensors to arrive at, for example, polymer-inorganic sensors that are not electrochemical in nature.

Barisci is combined with Gibson as allegedly providing the motivation to combine the teachings of Gibson with additional references (*i.e.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler). In particular, the Examiner alleges that Barisci provides, "... a connection between the different signal generation methods that would have been recognized by one of skill in the art ... " (see Office Action mailed January 25, 2005 at page 9, lines 10-11; and at page 3, first full paragraph of the Office Action mailed April 20, 2004 (Paper No. 35)).

Applicants respectfully submit that Barisci is being misconstrued and that the motivation relied upon by the Examiner is missing.

It appears that the basis for the Examiner's allegation is that Barisci allegedly describes analytes interacting with conductive polymers to modify current flow as a function of applied potential. This teaching is cumulative to Gibson, which teaches conductive polymer sensors. The addition of Barisci does not provide additional motivation to look to amperometric-electrochemical sensor systems. The mere fact that Barisci mentions amperometric-electrochemical sensors in isolation is insufficient to provide motivation. When read as a whole, Barisci further supports Applicants' contention that the application of amperometric-electrochemical electrode materials to conductimetric sensors would not be obvious to one of ordinary skill in the art.

Barisci acknowledges the distinction between amperometric-electrochemical sensors and conductimetric sensors throughout his paper. The portion of Barisci devoted to amperometric-electrochemical sensor describes reduction/oxidation (REDOX) reactions involving solvated ions and electron-transfer reactions for determining the presence of metal ions or small organic molecules. On the other hand, the portion of Barisci devoted to conductimetric sensors describes resistance changes in the polymer itself.

Furthermore, Barisci acknowledges the distinction between amperometric-electrochemical sensors and conductimetric sensors when Barisci describes the impact of counterions from the analyte on the different types of sensors. In discussing amperometric-electrochemical sensors, Barisci describes that the oxidation or reduction of the polymer backbone is influenced by certain counterion A^- generated by the analyte. As illustrated in FIG. 3 of Barisci, a counterion A^- (not an analyte) can transfer across the electrode/solution interface to bind with cationic polypyrrole. It is this current flow across the electrode/solution interface that is sensed in Barisci's amperometric-electrochemical sensors.

On the other hand, when Barisci describes conductimetric sensors, Barisci indicates that the resistance of the polymer is impacted by the exchange of counterions with those in solution. The polymer itself changes in structure. In such ion exchanges, there is no net current flow across the electrode/solution interface. Rather, a first anion (*e.g.*, A^-) exchanges with a second anion (*e.g.*, B^-). Depending upon the relative properties of the exchanged counterions (such as, *e.g.*, the relative

electronegativity and electronic states), the conductivity of the polymer itself may change. This conductivity change is detected in Barisci's conductimetric sensors.

In light of the distinctions set forth by Barisci, *i.e.*, (1) that amperometric sensors work by a counterion A^- transferring across the electrode/solution interface to bind with cationic polypyrrole and (2) that conductimetric sensor work by a first anion A^- exchanging with a second anion B^- , one of skill in the art would not have looked to materials used in amperometric-electrochemical sensor to improve conductimetric sensors since the "sensing" works by two very separate and distinct scientific principles. There is simply no reason to believe, based upon the teachings of Barisci that the conductivity of a material will, in any way, somehow be related to the exchange of charge at the interface of the material with a solution. Furthermore, based upon Barisci, the ion exchange capability of a material is not indicative that a material would absorb, adsorb or imbibe an analyte to cause a change in conductivity when a current is applied across the polymer.

The materials chosen to act as electrodes in amperometric-electrochemical sensors are selected based, at least in part, on the fact that their conductivity is not "sensed" (*e.g.*, preferably does not change) in the amperometric-electrochemical sensor. Accordingly, one of skill in the art would not look to or expect that materials present in amperometric-electrochemical electrodes would be useful in conductimetric sensor for the simple fact that they are not intended and would not function properly if they were to change conductivity. This "invisibility" is inapposite to the role of sensing materials in conductimetric sensors. Indeed, "sensing" the conductive properties of amperometric-electrochemical sensor electrodes will render the electrodes unfit for their intended use as sensors in amperometric-electrochemical systems. In fact, it is not the case at all that materials that are good electrochemical detectors will make good chemiresistors so obviousness does not flow from one to the other. An example of this is the use of ferrousine modified enzymatic sensors to detect glucose. These are good electrochemical sensors but make completely useless chemiresistors because in fact they are electronically resistive to DC current in both forms.

For at least all of the foregoing reasons one of skill in the art would not be motivated by the teachings of Barisci to combine amperometric-electrochemical sensor materials with the teachings of conductimetric sensors, even if the materials in the amperometric-electrochemical sensors function well for their intended

electrochemical sensing purpose. One of skill in the art aware of the teachings in the art (*e.g.*, Barisci) would not have been motivated to combine the teachings of amperometric-electrochemical sensors with the sensor materials described in Gibson. Thus, one of skill would not have been motivated to look to the teachings or combine the teachings of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler with Gibson.

Accordingly, Barisci does not provide the necessary motivation, teaching or suggestion that the Examiner relies upon to combine the additional amperometric-electrochemical teachings.

ii. The Combination Of Gibson And Barisci Fail To Teach Or Suggest Each And Every Element Of Applicants' Claimed Invention

Applicants' claimed invention recites, with the exception of claim 127, that the claimed structure comprises a "sensing area". The sensing area provides an electrical path through a conductive organic material and a conductive material compositionally different than the conductive organic material. Applicants respectfully submit that the materials in amperometric-electrochemical sensors are such that they are not "sensing area" as recited in Applicants' claims.

Amperometric-electrochemical sensors operate by measuring the flow of charge (*i.e.*, the current) across the electrode/solution interface. As described in the last paragraph on page 307 of Barisci, the rate of charge transfer across the electrode/solution interface is determined by a number of factors including the capacitance between the electrode and the solution and the availability of electronic states at the electrode surface that can participate in charge transfer with species in solution.

Since amperometric-electrochemical sensors rely upon measurement of the rate of charge transfer across the electrode/solution interface to identify species in solution, the "sensing area" of an amperometric sensor is the analyte/solution interface itself. Although the composition of the electrode impacts charge transfer (*e.g.*, by determining which electronic states are present in the solution), the electrode itself is not part of the sensing area.

Indeed, for an amperometric-electrochemical sensor to operate properly, the body of the electrode must generally be "invisible" to the sensing device. In amperometric electrochemical sensors, the body of the electrode is in electrical series with the electrode/solution interface. In other words, a charge will flow both through the body of the electrode AND across the electrode/solution interface. If the resistance of the body of the electrode is comparable to the resistance of the electrode/solution interface, then charge flow will be limited by both the body of the electrode and at the electrode/solution interface. If the resistance of the body of the electrode is higher, charge flow will essentially be limited by the body of the electrode alone.

In these situations (*i.e.*, when the resistance of the body of the electrode is "sensed"), amperometric-electrochemical sensors will not function as intended. In particular, the measurements made by the amperometric-electrochemical sensor will not reflect charge transfer across the electrode/solution interface. Rather, the measurements will reflect the electrical conduction of the body of the electrode. Such a "sensing" of the electrode body by the current sensor would thus render the electrode body unfit for its intended purpose in the amperometric-electrochemical sensor.

Thus, a composite of a conductive material and a compositionally different conductive material used as electrodes in amperometric-electrochemical sensors are not "sensing areas" as recited in Applicants' claims. Furthermore, nothing in Barisci suggests such a composite sensing area.

4. Gibson in view of Barisci and Casella

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Casella to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Casella teaches at page 218, Section 2.2 "Apparatus", that "[c]yclic voltammetry (CV) was done in a three-electrode cell using a Cu-PANI working electrode, a saturated calomel reference electrode (SCE) . . . and a platinum foil counter electrode." As such, the Casella electrodes have only a single conductive lead and measures REDOX reactions. The Casella reference does not teach or suggest a sensing area between at least two conductive leads or that a vapor is in direct contact with a sensor such that the vapor reacts with the material to change, for example, the resistance. Neither Barisci nor Casella teach or suggest the use of a composite of two compositionally different conductive materials as a "sensing area" in a conductimetric sensor.

In fact, the necessity of Casella is that the Cu-PANI composite material is "invisible" and conducts electrons and ions. The material was useful in amperometric-electrochemical electrodes because it did not react with the analytes (it did not absorb, adsorb, or imbibe an analyte) but merely underwent REDOX reactions. The Cu particles of the material served as catalyst for the oxidation of analytes (see, *e.g.*, Casella at page 222, left column, last paragraph to page 223, first column, line 6). For example, at page 224, "Conclusions," Casella states, "The

novelty of this study lies in the use of PANI films in alkaline media as an *inert* and stable organic matrix of copper-catalytic species." (Emphasis added).

One of skill in the art, reading Gibson, Barisci and Casella would not have been motivated to arrive at Applicants' invention because the sensor systems of Casella are directed to a fundamentally different methodology. Furthermore, because of the teaching in Casella that the Cu-PANI films are "inert", the Casella reference teaches that the materials have a feature that would not work in the methods and systems of Applicants' invention. As stated throughout the specification, Applicants' invention measures, for example, a resistance change in the sensing area when the analyte adsorbs, absorbs or imbibes upon the sensing material (e.g., the analyte *reacts with the sensing material changing the conductivity*). There is no suggestion in Casella that the Cu-PANI material is reactive with an analyte. In fact, the desirability of the material in Casella is in the fact that it conducts ions and electrons and that it is "inert" (see, e.g., page 224, "Conclusions"). This characteristic described for the Cu-PANI film of Casella actually teaches away from their use in the conductimetric systems of Applicants' invention.

However, even given the teaching away and the lack of motivation to combine, the combination of Gibson, Barisci and Casella fail to teach or suggest:

... alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, and wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected. . .

The combination does not teach or suggest the elements of Applicants' claimed invention (e.g., two conductive leads, a sensing area, a sensing area comprising two compositionally different materials, and changes in resistance across the sensor).

5. de Lacy Costello

It is unclear to Applicants if this reference is being cited under Section 103 or how the reference is being applied (e.g., alone or in combination with other references). Applicants respectfully submit that the Office Action mailed January 25,

2005, does not cite the de Lacy Costello reference at page 3 of the Office Action, but suddenly the reference appears at page 10.

Applicants submit that de Lacy Costello teaches sensors that comprise conductor material having an electrical conductivity that increases as the temperature increases. This is opposite of Applicants' claimed invention, which recites, ". . . wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases. . . ." (see, *e.g.*, claim 98). Thus, de Lacy Costello does not teach or suggest Applicants' claimed invention.

6. Gibson in view of Barisci and Thackeray *et al.*

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Thackeray *et al.* to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Thackeray *et al.* also teaches an electrochemical sensor as described above and thus one of skill in the art would not look to Thackeray *et al.* to overcome the deficiencies of Gibson. The chemistry that produces a signal in Thackeray *et al.* is electrochemical in nature, requiring an electrolyte media containing ions to maintain a potential on the sensor. The electrochemical reaction involves a transfer of faradic charge and associated ions between the sensor of Thackeray *et al.* and the phase containing the analyte to be sensed. Thus, a vapor comprising the analyte to be detected is not in direct contact with the sensor of Thackeray *et al.*. In the Office Action mailed October 23, 2002, the rejection addressed Applicants' arguments by stating that, "The Thackeray *et al.* reference is clearly sensitive to gases – hydrogen and oxygen." (See, e.g., page 12 of the October 23, 2002, Office Action). Applicants respectfully submit that Thackeray *et al.* is sensitive to hydrogen and oxygen *ions* because REDOX reactions are the basis of how the sensor system of Thackeray *et al.* works. Applicants respectfully submit that the sensors of Thackeray *et al.*, would cease to function if they were directly contacted with a vapor containing an analyte because the sensor would be unable to perform REDOX reactions. In other words, the sensor material would cease to conduct ions or electrons, would degrade, would cease to be invisible and thereby fail to function as an amperometric-electrochemical sensor. Furthermore, the sensor of Thackeray *et al.* would cease to function in the absence of an electrolyte solution as more fully described below.

As with Casella described above, Thackeray *et al.* utilize metallic particles as catalysts. For example, Thackeray *et al.* teach at page 6678, first column, lines 39-45, that Pt is an effective catalyst and that the polymer material increases the surface area compared to naked Au surfaces. Furthermore, Thackeray *et al.* state that the desirability of utilizing Pt in combination with poly(3-methylthiophene) is that Pt can be deposited in an amount that will allow the polymer to be equilibrated with the O₂/H₂O and H₂O/H₂ redox couples *without significantly altering the essential potential dependence of the polymer*. In other words, the Pt can effectuate catalysis necessary for REDOX while maintaining the "invisible" character of the polymer. Again this is conflict with Applicants' invention and thus teaches away from the use of such a material in conductimetric systems.

Thackeray *et al.* further indicates that such a material has difficulties because the device requires active catalyst in order to function properly (see, e.g., page 6679,

second column, lines 16-20). In addition, the material when used as a sensor requires electrolytes since the polymer is likely to be somewhat electrolyte dependent for a given potential (see, e.g., page 6679, second column, lines 20-22). Thus, Thackeray *et al.* teaches that the materials used in their sensor system are defective, particularly when used in the absence of electrolytes or in systems other than REDOX systems. The teachings of Thackeray *et al.* thus teach away from their use in a conductimetric system.

Thackeray *et al.* do not teach or suggest that an analyte is capable of adsorbing or adsorbing to the sensor material. The sensor material of Thackeray *et al.* is sensitive to change in electrons in the electrolyte medium (*i.e.*, oxidation or reduction due to the presence of hydrogen or oxygen ions). Thus, a vapor cannot be in direct contact with the sensor of Thackeray *et al.* for the sensor to function as intended.

The combination of Gibson, which does not teach a single sensing area between two conductive leads comprising compositionally different conducting materials, with Thackeray *et al.*, which also does not teach a single sensing area comprising two conductive materials between two conductive leads that is in direct contact with a vapor comprising an analyte. Thus, the combination of Gibson in view of the alleged motivation by Barisci and further in view of Thackeray *et al.* fail to teach or suggest:

... alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, and wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected. . .

Accordingly, the combination cannot render Applicants' invention obvious as the references teach away from the combination, there is no motivation to combine the references and even if combined the references fail to teach each and every element of Applicants' claimed invention.

7. Gibson in view of Barisci and Yamato *et al.*

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Yamato *et al.* to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, e.g., the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (e.g., Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Yamato *et al.* teach an electrode for electrochemical measurements. The electrode material of Yamato *et al.* is utilized in a "three-electrode cell containing 5 ml of 0.1 M KCl/0.1 M phosphate buffer (PB, pH 7.5) solution." (See page 232, Section 2.4, "Measurements"). Yamato *et al.* teaches metal particles introduced into conducting polymers show efficient *catalytic* activity in hydrogen evolution and oxidation of methanol. Furthermore, that the materials in Yamato *et al.* do not serve to adsorb, absorb or imbibe an analyte but rather serve to electrochemically detect an analyte by using metal as catalysts (see, e.g., page 231, first column, line 14 to

second column, line 2). Yamato *et al.* teach sensors having on their surface glucose oxidase (GOD) (see, Yamato *et al.* at page 235, first column, section 3.2). Applicants submit that an enzyme linked electrochemical (oxidation reduction) system is far removed from Applicants' claimed invention and thus one of skill in the art would not look to Yamato *et al.* to overcome the deficiencies of Gibson.

Thus, Yamato *et al.* teach only electrochemical sensors consisting of a single electrical lead and measures a change in REDOX at the sensor interface with the electrolyte medium. Yamato *et al.* do not teach or suggest resistivity measurements. Applicants submit that even if there were motivation to combine Gibson, Barisci and Yamato *et al.*, which there is not, at most the combination would teach the use of immobilized enzymes on a polymer material for use in an electrochemical system. The combination, as with the previous combinations, fails to teach or suggest:

... alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, and wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected. . .

Accordingly, the combination cannot render Applicants' invention obvious as there is no motivation to combine the references and even if combined the references fail to teach each and every element of Applicants' claimed invention.

8. Gibson in view of Barisci and Naarmann

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Naarmann to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged

motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Naarmann teaches that the electrochemical polymer material can be used as an electrode or as sensor electrodes in electrochemical storage cells (see English Abstract). The Examiner alleges at page 12 of the Office Action mailed January 25, 2005, that Naarmann teaches manufacture and use of electrically conductive polymers of five-membered heterocyclic compounds and anions of tetrathiafulvalene derivatives (representing the organic conductor/organic conducting polymer combination). Applicants submit that even if Naarmann teaches such a combination it is irrelevant to Applicants' claims as the compositionally different material in Applicants' invention is selected from an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor. Naarmann does not teach or suggest such inorganic composition mixtures.

Gibson admittedly does not teach or suggest such inorganic blends and Naarmann also does not teach or suggest such inorganic blends. Thus, the combination of Gibson, Barisci and Naarmann fails to teach or suggest Applicants' claimed invention. Thus, Gibson in view of the alleged motivation by Barisci and further in view of Naarmann fail to teach or suggest the following element of Applicants' claims:

... alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material. . . "

In addition, Gibson in combination with Naarmann also fails to teach or suggest the materials that can make up the compositionally different conductive material, namely,

...selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof. ...

Accordingly, the combination of Gibson in view of Barisci and further in view of Naarmann fails to provide a *prima facie* case of obviousness as (1) there is no motivation to combine the references, and (2) even if there was motivation to arrive at the combination, the combination fails to teach or suggest each and every element of Applicants' claims.

9. Gibson in view of Barisci and Li

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Li to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance

measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

As with the foregoing references Li also teaches amperometric-electrochemical sensor systems. Li shows the use of a PANI-Pd film as an electrode (*e.g.*, a cathode/anode) in an electrochemical cell (see, *e.g.*, page 583-584). Applicants submit that Li is cumulative to Casella discussed above. Again, the purpose of Pd in such conductive films is to provide the necessary catalyst for REDOX reactions in an electrolyte solution. Li does not teach or suggest a sensor comprising two conductive leads separated by a sensing area that undergoes a measurable change due to adsorption or absorption of an analyte.

The combination of Gibson in view of Barisci and further in view of Li fails to provide a *prima facie* case of obviousness for the same reason as Casella (discussed above).

10. Gibson in view of Barisci and Sakaguchi

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Sakaguchi to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12,

paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Sakaguchi is directed to amperometric-electrochemical system. Sakaguchi teaches electrode reactions (see, e.g., page 7, lines 11-12 of the Final Office Action mailed May 7, 2003 (Paper No. 29)). Sakaguchi does not teach or suggest a sensor comprising a sensing area between two conductive leads that undergoes a measurable change due to adsorption or absorption of an analyte. Sakaguchi does not teach or suggest conductimetric sensors. Thus, Sakaguchi fails to overcome the deficiencies of Gibson and Barisci. Accordingly, the combination of Gibson in view of Barisci and further in view of Sakaguchi fails to provide a *prima facie* case of obviousness as the combination fails to (1) provide motivation to combine the references and (2) fails to teach or suggest each and every element of Applicants' claimed invention.

11. Gibson in view of Barisci and Stetter

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Stetter to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, e.g., the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (e.g., Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged

motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Stetter teaches the use of a chemiresistive layer comprising a mixture of conductive particles and an elastomer/polymer (see, column 3, lines 5-9). Various polymers are identified at column 4, lines 49-55, and consist of ethylene propylene, styrene butadiene, silicone, fluorsilicone, butyl rubber, isobutylene isoprene, chloroprene, fluorocarbon and polyacrylate, all commonly used insulating polymers. Thus, Stetter does not teach a mixture of two compositionally different *conductive* materials, but to the contrary teaches and suggests only mixtures of conductive material and non-conductive material.

Applicants submit that Stetter does not overcome the deficiencies of Gibson and/or Barisci. Thus, the combination of Gibson in view of Barisci and further in view of Stetter fails to teach and suggest each and every element of Applicants' claimed invention. For example, the combination fails to teach ". . .alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material. . ." (see, *e.g.*, claim 98). Accordingly, a *prima facie* case of obviousness has not been made.

12. Gibson in view of Barisci and Wampler

The teachings of Gibson were addressed above. Barisci has been addressed above and allegedly provides the motivation to combine Gibson with Wampler to overcome the deficiencies of Gibson.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Wampler teaches that polypyrrole composites are useful for eliminating Cr(VI) in the environment by reducing Cr(VI) to Cr(III) (see, *e.g.*, page 1820). Wampler does not teach or suggest sensors and sensor systems. There is no teaching or suggestion that any material in Wampler would be useful as a material in either an amperometric-electrochemical sensor system or in a conductimetric sensor system. Applicants respectfully submit that the addition of Wampler, which has nothing to do with sensor systems, is based upon hindsight reconstruction, wherein the Examiner is picking and choosing among references that have no bearing on sensor systems

to arrive at Applicants' invention. Such hindsight reconstruction and picking and choosing among references where there is no suggestion in the art for such combination cannot be done. Applicants respectfully submit that the combination of Gibson, Barisci and Wampler does not provide a *prima facie* case of obviousness because (1) there is no motivation to combine the references, (2) the combination is based upon hindsight reconstruction utilizing Applicants' disclosure as a blueprint, and (3) even if there was some motivation to combine the references, which there is not, the combination fails to teach or suggest each and every element of Applicants' claimed invention.

B. REJECTION OF CLAIMS 114, 116, 136, 138 and 158 OVER GIBSON IN VIEW OF BARISCI AND FURTHER IN VIEW OF CASELLA, THACKERAY *ET AL.*, YAMATO, NAARMANN, LI, SAKAGUCHI, STETTER OR WAMPLER AND YET FURTHER IN VIEW OF BREHERET, MIFSUD, MOY OR PERSAUD

1. Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler

The teachings of Gibson, Barisci, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter and Wampler were addressed above. Applicants submit that (1) there is no motivation to combine the references, (2) that many of the references teach away from such combination, (3) that combinations of the references are based upon hindsight reconstruction, and (4) that even if combined, the combination fails to teach or suggest each and every element of Applicants' claimed invention.

Gibson, as the primary reference, admittedly does not teach or suggest a composition in which the two conductive materials are mixed together to form a single sensing area or as an array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed April 20, 2004 (Paper No. 35) at page 3, lines 2-5). Furthermore, Gibson admittedly does not teach or suggest a temperature control apparatus in thermal communication with at least one sensor or a sensing array having sensors that are not organic polymer based (see, *e.g.*, the Office Action mailed January 25, 2005, at page 15, lines 16-18).

The secondary references (*e.g.*, Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler) are applied based upon the alleged motivation provided by Barisci to allegedly teach or suggest that composites were known as gas sensors or would have been expected to form a sensing area that would have enhanced properties relative to the conducting polymers used by Gibson (see, the Office Action mailed October 23, 2002 (Paper No. 24) at page 12, paragraph 8). As discussed above, Barisci provides no such motivation. What Barisci provides is a description of the operation of the various sensor types, indicating that amperometric-electrochemical sensors are based upon REDOX reactions, lack sensing areas and are fundamentally different than resistance measurements as recited in Applicants' claims. However, even if there was motivation to combine the references, which there is not, the combination does not teach or suggest each and every element of Applicants' claimed invention. Furthermore, many of the references actually teach away from the alleged combination.

Applicants submit that the independent claims are nonobvious over the various combinations as described and argued above. The addition of Breheret, Mifsud I and Mifsud II, Moy or Persaud, not only must overcome the deficiencies of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler, but must also provide a *prima facie* case of obviousness for claims 114, 116, 136, 138 and 158 (all dependent claims). Furthermore, as the case is here, if an independent claim is nonobvious under 35 U.S.C. §103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); MPEP §2143.03.

The arguments made above with respect to the rejection of claims 98-110, 112-113, 115, 117-123, 126-135, 137, 139-157 and 159 over Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler are incorporated in this Section "B".

2. Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler and yet further in view of Breheret

Breheret is applied to overcome the deficiencies of the various combinations of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler. Breheret is cited for the alleged teaching that a temperature controller is used. Applicants respectfully submit that even if Breheret teaches a temperature controller, Breheret does not overcome the deficiencies of the foregoing references in providing a *prima facie* case of obviousness for Applicants' independent claims.

Breheret mentions two different types of sensors: (1) semiconductor gas sensors, and (2) conducting polymer sensors. Neither of the two types of sensors is described nor does Breheret teach or suggest the composition of the sensors. The only description found in the Breheret reference is to the "AROMASCAN A20S Device". Applicants respectfully submit that the Breheret reference is not enabling for any teaching relied upon by the Examiner to render Applicants' invention obvious. For example, there is no teaching or suggestion in Breheret that overcomes the deficiencies of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler. In other words, the combination of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler and yet further in view of Breheret fails to teach or suggest all of the elements of Applicants' independent claims. For example, any of the foregoing combinations fails to teach or suggest:

. . . a sensing area comprising alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material. . .

(See, e.g., claim 98).

In addition, the combinations fail to teach or suggest:

. . . a compositionally different conductive material selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof. . .

(See, *e.g.*, claim 98).

Furthermore, semiconductive material (*i.e.*, a semiconductive gas sensor) has an electrical conductivity that increase as the temperature increases. This is contrary to Applicants' claimed invention which recites, ". . . wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases. . . ." (See, *e.g.*, claim 98).

However, even if the Breheret reference was enabled, Breheret teaches away from Applicants' claimed invention due to the teaching in Breheret that polymer films are less sensitive than semiconductive gas sensors (see, *e.g.*, the "Abstract" and page 106, lines 17-20). Furthermore, this teaching in Breheret would teach one of skill in the art that the sensors of Gibson are not desirable and thus would teach way from Gibson.

For at least the foregoing reasons the combination of the references fails to provide a *prima facie* case of obviousness. In particular, the combination teaches away from various elements of Applicants' invention, there is no motivation to combine the references, and even if combined the combination fails to teach each and every element of Applicants' claimed invention as set forth in the independent claims.

3. Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler and yet further in view of Mifsud (U.S. Patent 5,801,297 - "Mifsud I"; WO 95/08113 - "Mifsud II")

Mifsud I and II are applied to overcome the deficiencies in the various combinations of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler. Mifsud I and II are cited for the alleged teaching that a temperature controller is used. Applicants respectfully submit that even if Mifsud I and II teach a temperature controller, Mifsud I and II do not overcome the deficiencies of the foregoing references in providing a *prima facie* case of obviousness for Applicants' independent claims.

Mifsud I and II teach that polymer sensors are less sensitive than semiconductive sensors (see, *e.g.*, column 1, lines 62-64). In order to overcome this lack of sensitivity Mifsud I and II combine different sensor types (*e.g.*,

semiconductive sensors, polymer sensors, and surface-acoustic-wave sensors). Mifsud I teaches combining sensor types *not* changing sensor materials. Mifsud I described the advantages of Mifsud's invention at column 3, lines 22-32:

The point of this . . . is to provide. . . three different means of detection in order to obtain better sensitivity and better general selectivity of detection. In fact, as has been explained at the beginning of the description, the different types of sensors, with semiconductive, conductive polymer or surface acoustic wave technology, each have different characteristics which are complementary: good sensitivity (semiconductive sensors), good selectivity (conductive-polymer sensors), and good mass/volume measurement (surface-acoustic-wave sensors).

Thus, Mifsud I and II when combined with the additional references (1) fails to provide any motivation to look to polymer-based sensors and actually teaches away from polymer-based sensors and (2) fails to teach and suggest each and every element of Applicants' claimed invention. For example, any of the foregoing combinations fails to teach or suggest:

. . . a sensing area comprising alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material. . .

(See, e.g., claim 98).

In addition, the combinations fail to teach or suggest:

. . . a compositionally different conductive material selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof. . .

(See, e.g., claim 98).

Furthermore, semiconductive material (*i.e.*, semiconductor gas sensors) has an electrical conductivity that increase as the temperature increases. This is contrary to Applicants' claimed invention which recites, ". . . wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases. . . ." (See, e.g., claim 98).

For at least the foregoing reasons the combination of the references fails to provide a *prima facie* case of obviousness. In particular, the combination teaches away from various elements of Applicants' invention, there is no motivation to combine the references, and even if combined the combination fails to teach each

and every element of Applicants' claimed invention as set forth in the independent claims.

4. Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler and yet further in view of Moy

Moy is applied to overcome the deficiencies in the various combinations of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler. Moy is cited for the alleged teaching that it provides pattern recognition methods for fast odor classifications. Applicants respectfully submit that even if Moy teaches such pattern recognition Moy does not overcome the deficiencies of the foregoing references in providing a *prima facie* case of obviousness for Applicants' independent claims.

Moy does not teach or suggest the composition of the sensor materials. For example, Moy does not teach or suggest a material comprising a conductive organic material and a compositionally different conductive material. Rather, Moy, at most, teaches an array made up of one or more metal oxide sensors and one or more polymer sensors. There is no teaching or suggestion in Moy that overcomes the deficiencies of Gibson in combination with Barisci and further in combination with Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler.

Thus, Moy when combined with the additional references (1) fails to provide any motivation to look to amperometric-electrochemical sensors and (2) fails to teach and suggest each and every element of Applicants' claimed invention. For example, any of the foregoing reference combinations fails to teach or suggest:

... a sensing area comprising alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material. . .

(See, *e.g.*, claim 98).

In addition, the combinations fail to teach or suggest:

. . . a compositionally different conductive material selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof. . .

(See, *e.g.*, claim 98).

Furthermore, semiconductive material (*e.g.*, metal oxide sensors) has an electrical conductivity that increase as the temperature increases. This is contrary to Applicants' claimed invention which recites, ". . . wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases. . . ." (See, *e.g.*, claim 98).

For at least the foregoing reasons the combination of the references fails to provide a *prima facie* case of obviousness. In particular, the combination teaches away from various elements of Applicants' invention, there is no motivation to combine the references, and even if combined the combination fails to teach each and every element of Applicants' claimed invention as set forth in the independent claims.

5. Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler and yet further in view of Persaud

Persaud is applied to overcome the deficiencies in the various combinations of Gibson in view of Barisci and further in view of Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler.

Persaud does not teach or suggest the composition of the sensor materials of Applicants' invention. For example, Persaud does not teach or suggest a material comprising a conductive organic material and a compositionally different conductive material. Persaud teaches at most a sensor having an organic polymeric material such as polyindole (see, *e.g.*, page 4, line 2). There is no teaching or suggestion in Persaud that overcomes the deficiencies of Gibson in combination with Barisci and further in combination with Casella, Thackeray *et al.*, Yamato *et al.*, Naarmann, Li, Sakaguchi, Stetter or Wampler.

Thus, Persaud when combined with the additional references (1) fails to provide any motivation to look to amperometric-electrochemical sensors and (2) fails

to teach and suggest each and every element of Applicants' claimed invention. For example, any of the foregoing reference combinations including Persaud fails to teach or suggest:

... a sensing area comprising alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material. . .

(See, *e.g.*, claim 98).

In addition, the combinations fail to teach or suggest:

... a compositionally different conductive material selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof. . .

(See, *e.g.*, claim 98).

For at least the foregoing reasons the combination of the references fails to provide a *prima facie* case of obviousness. In particular, the combination teaches away from various elements of Applicants' invention, there is no motivation to combine the references, and even if combined the combination fails to teach each and every element of Applicants' claimed invention as set forth in the independent claims.

C. UNEXPECTED RESULTS

It is impermissible to ignore the advantages, properties, utilities and unexpected results that flow from the claimed invention; they are part of the invention as a whole. *In re Wright*, 848 F.2d 1216, 6 USPQ2d 1959 (Fed. Cir. 1988). In the Office Action mailed January 25, 2005, the Examiner alleges that the advantages and unexpected results provided by Applicants are not commensurate in scope with the instantly applied references. The Examiner indicates that for unexpected results to be relevant the comparison should be between the closest prior art and the claimed device.

Although evidence of unexpected results must compare the claimed invention with the closest prior art, Applicant submits that it is not required to compare the claimed invention with subject matter that does not exist in the prior art. Here,

Applicants have compared the claimed invention to a sensor that comprises a "composite" of two materials. The Examiner has admitted that the teachings in the art fail to teach a composite of two conductive materials. It appears that what the Examiner is requiring is that Applicants compare the claimed invention with subject matter that does not exist in the prior art. The Applicants are not required to make such a comparison with non-existent material. *In re Geiger*, 815 F.2d 686,689 (Fed. Cir. 1987). In this regard, the Applicants submit that requiring a comparison of the claimed invention with a polymer composite allegedly suggested by the combination of references relied upon in the rejection of the claimed invention under 35 U.S.C. §103 "would be requiring comparison of the results of the invention with the results of the invention." *In re Chapman*, 357 F.2d 418, 422 (CCPA 1966). See also MPEP Section 716.02(e)(II-III).

The specification at Figure 4 and page 15, lines 12-18 demonstrate that the "response is orders of magnitude larger than any seen from sensors prepared from insulating polymer-carbon black composite films." The Board is also directed to page 82, lines 20-23, which states, "Sensors prepared from emeraldine . . . consistently exhibit a response to amines which is several orders of magnitude larger than any observed from conventional polymer-carbon black sensors." Applicants maintain that the unexpected results demonstrated in the specification are relevant composite materials comprising a conductive material (*i.e.*, carbon black) and as such must be given weight.

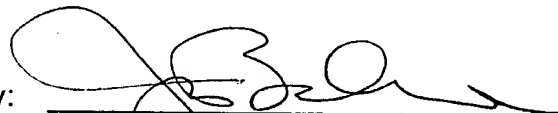
See attached Claims Appendix for a copy of the claims involved in the appeal.

Respectfully submitted,

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Appendix of Claims

98. A sensor, comprising:

at least two conductive leads;

a sensing area comprising alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, and wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an inorganic conductor, a carbon black, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, a superconductor, or a combination thereof and wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increase; and

an apparatus in electrical communication with the conductive leads for detecting a change in the sensing area between the at least two conductive leads when contacted with an analyte.

99. The sensor according to claim 98, wherein the conductive organic material is selected from the group consisting of a polyaniline, an emeraldine salt of polyaniline, a polypyrrole, a polythiophene, a polyEDOT, and derivatives thereof.

100. The sensor according to claim 98, wherein the compositionally different conductive material is carbon black.

101. The sensor according to claim 98, further comprising an insulator or plasticizer.

102. The sensor of claim 98, wherein the conductive organic material is an emeraldine salt of polyaniline and the compositionally different conductive material is carbon black.

103. The sensor of claim 98, wherein the conductive organic material is a doped polyaniline and the compositionally different conductive material is carbon black.

104. A sensor, comprising:

at least two conductive leads;

a sensing area comprising alternating interpenetrating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between and in contact with the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, and wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an organic conductor, an organic complex, an inorganic conductor and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, or a superconductor, or a combination thereof and wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases; and

an apparatus in electrical communication with the conductive leads for detecting a change in the sensing area between the at least two conductive leads when contacted with an analyte.

105. A sensor, comprising:

at least two conductive leads;

a sensing area comprising dispersed regions of a conductive organic material and a conductive material compositionally different than the conductive organic material wherein the dispersed regions provide interpenetrating regions of the

conductive organic material and a conductive material compositionally different than the conductive organic material, the sensing area disposed between and in contact with the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, and wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an organic conductor, an organic complex, an inorganic conductor and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, or a superconductor, or a combination thereof and wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases; and

an apparatus in electrical communication with the conductive leads for detecting a change in the sensing area between the at least two conductive leads when contacted with an analyte.

106. A sensor, comprising:

at least two conductive leads;

a sensing area comprising alternating interpenetrating regions of a polyaniline or an emeraldine salt of polyaniline and a conductive material compositionally different than the polyaniline or emeraldine salt of polyaniline disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the alternating interpenetrating regions of polyaniline or emeraldine salt of polyaniline and the conductive material compositionally different than the polyaniline or emeraldine salt of polyaniline; and

an apparatus in electrical communication with the conductive leads for detecting a change in the sensing area between the at least two conductive leads when contacted with an analyte.

107. The sensor of claim 106, wherein the conductive material compositionally different than the polyaniline or emeraldine salt of polyaniline is selected from the

group consisting of an organic conductor, an organic complex, an inorganic conductor, and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, an oxidized metal, a superconductor, and any combination thereof.

108. A sensor array comprising:

a plurality of sensors, wherein at least one sensor comprises:

at least two conductive leads;

a sensing area comprising alternating interpenetrating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between an in contact with the at least two conductive leads, wherein the sensing area provides an electrical path through the alternating interpenetrating regions of the conductive organic material and the regions of the compositionally different conductive material, wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an organic conductor, an organic complex, an inorganic conductor and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, or a superconductor, or a combination thereof and wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases.

109. The sensor array according to claim 108, wherein the sensor array comprises a plurality of sensors each comprising regions of a conductive organic material and regions of a conductive material compositionally different than the conductive organic material wherein the conductive organic material of at least one sensor is different from the conductive organic material of at least one other sensor.

110. The sensor array according to claim 108, wherein the compositionally different conductive material is an inorganic conductor.

112. The sensor array according to claim 159, wherein the conductive organic material of one sensor of the plurality of sensors is compositionally different than at least one other sensor of the plurality of sensors.

113. The sensor array according to claim 108, wherein the conductive organic material is selected from the group consisting of a polyaniline, an emeraldine salt of polyaniline, a polypyrrole, a polythiophene, and a polyEDOT, and the conductive material compositionally different than the conductive organic material is selected from the group consisting of Ag, Au, Cu, Pt, carbon black, and AuCu.

114. The sensor array according to claim 108 or 113, further comprising a temperature control apparatus in thermal communication with at least one sensor.

115. The sensor array according to claim 108 or 113, further comprising an apparatus for detecting a change selected from the group consisting of resistance, conductance, impedance, and capacitance in the electrical properties of at least one sensor.

116. The sensor array according to claim 115, further comprising a temperature control apparatus in thermal communication with at least one sensor.

117. The sensor array according to claim 110, wherein the inorganic conductor is selected from the group consisting of Ag, Au, Cu, Pt, and AuCu.

118. The sensor array according to claim 108, wherein the compositionally different conductive material is carbon black.

119. The sensor array according to claim 108, wherein the compositionally different conductive material is an organic conductor.

120. The sensor array according to claim 108, wherein the conductive material compositionally different than the conductive organic material is a member selected from the group consisting of an organic conductor, an inorganic conductor, and a mixed inorganic/organic conductor.

121. The sensor array according to claim 108, wherein the conductive material compositionally different than the conductive organic material is a member selected from the group consisting of a metal, a metal alloy, a metal oxide, an organic complex, a superconductor, and a mixed inorganic/organic conductor.

122. The sensor array according to claim 108, wherein the compositionally different conductive material is a particle.

123. The sensor array according to claim 159, wherein the compositionally different conductive material of each of the sensors in the plurality of sensors comprises a conductive organic material.

126. A sensor array comprising:

a plurality of sensors, wherein at least one sensor comprises:

at least two conductive leads;

a sensing area comprising alternating interpenetrating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an organic conductor, an organic complex, an inorganic conductor, and a mixed inorganic/organic conductor,

wherein the inorganic conductor is a metal a metal alloy, a metal oxide, a superconductor, or a combination thereof, wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases; and

a measuring apparatus electrically coupled to the at least two conductive leads for detecting a change in the sensing area when contacted with an analyte.

127. A sensor array comprising:

a plurality of sensor wherein at least one sensor comprise alternating interpenetrating regions of a conductive organic material and regions of a compositionally different conductive material wherein the sensors are in direct contact with a vapor comprising an analyte to be detected; and

means, electrically coupled to the plurality of sensors, for detecting a change in the plurality of sensors when contacted with an analyte.

128. A sensor array system comprising:

a plurality of sensors, wherein at least one sensor comprises:

at least two conductive leads;

a sensing area comprising alternating interpenetrating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between and in contact with the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material, wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an organic conductor, an organic complex, an inorganic conductor and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, or a superconductor or a combination thereof and wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases;

a measuring apparatus that detects a change in the electrical properties of the at least one sensor, wherein at least one sensor is in communication with the measuring apparatus; and

a computer comprising a resident algorithm, wherein the computer processes the change in the electrical properties.

129. The sensor array system according to claim 128, wherein the measuring apparatus is an electrical measuring device.

130. The sensor array system according to claim 128, wherein the compositionally different conductive material is an inorganic conductor.

131. The sensor array system according to claim 128, wherein the plurality of sensors each comprise regions of a conductive organic material and regions of a conductive material compositionally different than the conductive organic material.

132. The sensor array system according to claim 131, wherein the conductive organic material of at least one sensor is different from the conductive organic material of at least one other sensor.

133. The sensor array system according to claim 131, wherein the conductive organic material of the plurality of sensors are compositionally the same.

134. The sensor array system according to claim 128, wherein the change in electrical properties is selected from the group consisting of impedance, conductance, capacitance, inductance, and resistance in the sensors.

135. The sensor array system according to claim 128, wherein the conductive organic material is selected from the group consisting of a polyaniline, an emeraldine

salt of polyaniline, a polypyrrole, a polythiophene, and a polyEDOT, and the conductive material compositionally different than the conductive organic material is selected from the group consisting of Ag, Au, Cu, Pt, carbon black, and AuCu.

136. The sensor array system according to claim 128 or 135, further comprising a temperature control apparatus in thermal communication with at least one sensor.

137. The sensor array system according to claim 128 or 135, wherein the change in electrical properties is a change in an electrical impedance.

138. The sensor array system according to claim 137, further comprising a temperature control apparatus in thermal communication with at least one sensor.

139. The sensor array system according to claim 130, wherein the inorganic conductor is a member selected from the group consisting of Ag, Au, Cu, Pt, and AuCu.

140. The sensor array system according to claim 128, wherein the compositionally different conductive material is carbon black.

141. The sensor array system according to claim 128, wherein the compositionally different conductive material is an organic conductor.

142. The sensor array system according to claim 128, wherein the conductive material compositionally different than the conductive organic material is selected from the group consisting of an organic conductor, an inorganic conductor, and a mixed inorganic/organic conductor.

143. The sensor array system according to claim 128, wherein the conductive material compositionally different than the conductive organic material is selected from the group consisting of a metal, a metal alloy, a metal oxide, an organic complex, a superconductor, and a mixed inorganic/organic conductor.

144. The sensor array system according to claim 128, wherein the compositionally different conductive material is a particle.

145. The sensor array system according to claim 128, wherein each of the sensors comprises a conductive organic material.

146. The sensor array system according to claim 128, wherein the conductive organic material is an organic polymer.

147. The sensor array system according to claim 128, wherein the resident algorithm is a member selected from the group consisting of principal component analysis, Fisher linear analysis, neural networks, genetic algorithms, fuzzy logic, pattern recognition, and combinations thereof.

148. A system for identifying a microorganism, the system comprising:

a measuring apparatus;

a sensor array comprising a plurality of sensors in communication with the measuring apparatus, wherein at least one sensor comprises:

at least two conductive leads;

a sensing area comprising alternating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between and in electrical communication with the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally

different conductive material, and wherein the sensing are is in direct contact with a vapor comprising a biomarker to be detected; and

a computer comprising a resident algorithm;

wherein the measuring apparatus is capable of detecting a response from each sensor in the array wherein the response are indicative of the presence of a biomarker of a microorganism and the computer is capable of assembling the responses into a response profile whereby the computer associates the response profile indicative of the biomarker with a microorganism for microorganism identification.

149. The system for identifying a microorganism in accordance with claim 148, wherein the resident algorithm of the computer is a member selected from the group consisting of principal component analysis, Fisher linear analysis, neural networks, genetic algorithms, fuzzy logic, pattern recognition, and combinations thereof.

150. The system for identifying a microorganism in accordance with claim 148, further comprising the steps of:

providing an information storage device coupled to the measuring apparatus;
and

storing information in the information storage device.

151. The system for identifying a microorganism in accordance with claim 148, wherein the measuring apparatus includes a digital-analog converter.

152. A system for detecting an analyte in a sample, comprising:

a substrate having a plurality of sensors wherein at least one sensor comprises:

at least two conductive leads;

a sensing area comprising alternating interpenetrating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between, and in contact with, the at least two conductive leads, wherein the sensing area provides an electrical path through the regions of the conductive organic material and the regions of the compositionally different conductive material such that the at least one sensor provides a response that varies according to the presence of an analyte in contact with it, wherein the sensing area is in direct contact with a vapor comprising an analyte to be detected, wherein the compositionally different conductive material is selected from the group consisting of an organic conductor, an organic complex, an inorganic conductor and a mixed inorganic/organic conductor, wherein the inorganic conductor is a metal, a metal alloy, a metal oxide, or a superconductor, or a combination thereof and wherein the inorganic conductor has an electrical conductivity that decreases as the temperature increases;

a detector operatively associated with the plurality of sensors, for measuring the response of the plurality of sensor when contacted with the sample;

a sample delivery unit for delivering the sample to be tested to the plurality of sensors; and

an information storage and processing device configured to store an ideal response for a predetermined analyte and to compare the response of the plurality of sensor with the stored ideal response, to detect the presence of the analyte in the sample.

153. The system in accordance with claim 152, wherein the information storage and processing device is configured to store ideal responses for a plurality of predetermined analytes; and

the information storage and processing device further is configured to compare the response of the plurality of sensors with the plurality of stored ideal responses, to detect the presence of each analyte in the sample.

154. The system in accordance with claim 152, wherein the sample is a liquid and the sample delivery unit comprises:

a flow passage interconnecting the substrate comprising the plurality of sensor with a mixture containing the liquid;

a gas-permeable, liquid-impermeable shield interposed in the flow passage;
and

a device for extracting vapor from the liquid and for delivering the extracted vapor along the flow passage to the substrate comprising the plurality of sensors via the flow passage.

155. The system in accordance with claim 152, wherein the sample is gaseous and the sample delivery unit comprises:

a gas flow passage; and

a pump for pumping the gaseous sample to the substrate comprising the plurality of sensors via the gas flow passage.

156. The system in accordance with claim 152, wherein the sample is a vapor extracted from a solid and the sample delivery unit comprises:

a vapor flow passage; and

a pump for pumping the vapor extracted from the solid to the substrate comprising the plurality of sensors via the vapor flow passage.

157. The system in accordance with claim 152, wherein the detector detects a member selected from the group consisting of electromagnetic energy, optical properties, resistance, capacitance, inductance, impedance, and combinations thereof.

158. The system in accordance with claim 152, wherein at least one other sensor I the plurality of sensors comprises a member selected from the group consisting of a

surface acoustic wave sensor; a quartz microbalance sensor; a conductive composite; a chemiresistor; a metal oxide gas sensor; a conducting polymer sensor; a dye-impregnated polymer film on fiber optic detector; a polymer-coated micromirror; an electrochemical gas detector; a chemically sensitive field-effect transistor; a carbon black-polymer composite; a micro-electro-mechanical system device; and a micro-opto-electro-mechanical system device.

159. The sensor array of claim 108, wherein the plurality of sensors comprise at least two conductive leads and a sensing area comprising alternating interpenetrating regions of a conductive organic material and a conductive material compositionally different than the conductive organic material disposed between and in electrical communication with the at least two conductive leads.

Evidence Appendix

Figure 1

Figure 2

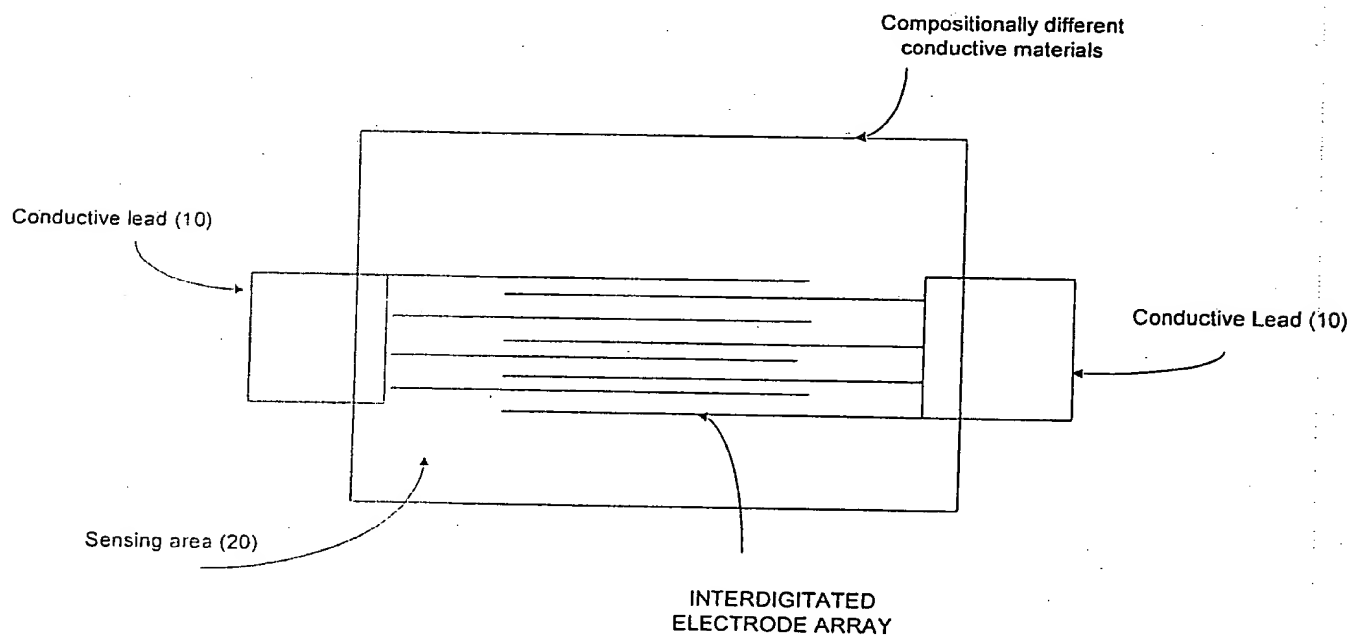
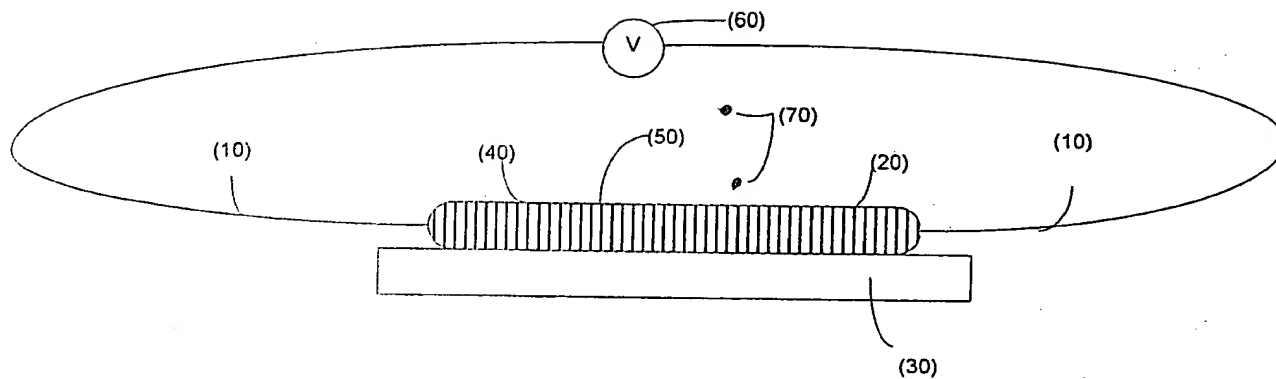
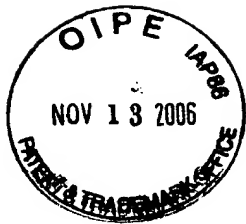


FIG. 1

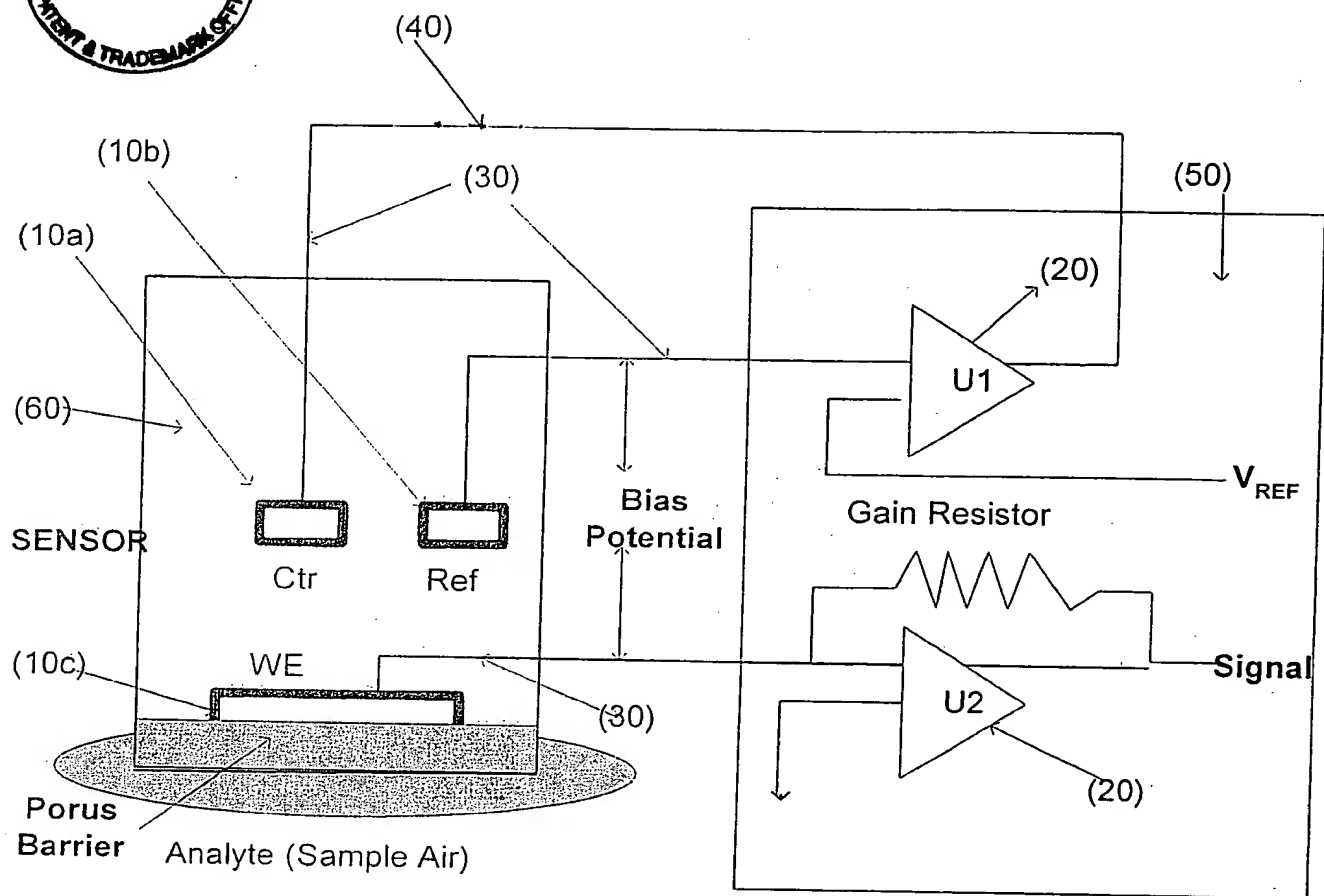


FIG. 2



Patent

Attorney Docket No. 1034345-000086

Related Proceedings Appendix

Related Proceedings - NONE